



## SECTION 5

### SELECTING THE RIGHT TYPE AND GRADE

Successful performance of asphalt emulsions requires selecting the proper type and grade for the intended use. Guidelines presented in this chapter should help select the specific grade and type of emulsion to be used.

The first consideration in picking the right type and grade of emulsion is how the emulsion will be used. Is it for a seal coat, a plant mix (central or mixed-in-place), a recycled mix or a prime coat application? Is it for some type of surface application, such as a chip seal, fog seal, slurry seal or micro-surfacing? Is it for a maintenance mix? Once this decision is made, other project variables must then be considered. Some other factors that affect the selection are:

- Climatic conditions anticipated during construction. The choice of emulsion grade, the design of mix or treatment and the selection of construction equipment should be dictated by the conditions at the time of construction.
- Aggregate type, gradation and availability.
- Construction equipment availability.
- Geographical location. The hauling distance and, in some cases, water availability are important considerations.
- Traffic control. Can traffic be detoured or only controlled through the work area?
- Environmental considerations.

While general guidelines can be given for selecting emulsions, laboratory testing is strongly recommended. There is no good substitute for a laboratory evaluation of the emulsion and the aggregate to be used. Different types and quantities of emulsion should be tried with the aggregate to find the best combination for the intended use. An experienced technician can determine the type and amount of emulsion to be used.

#### 5.1 General Emulsion Uses

Each grade of asphalt emulsion is designed for specific uses. They are described in general terms here. [Table 5-1 General Uses of Asphalt Emulsion](#) shows the general uses of standard asphalt emulsion types and grades.

##### 5.1.1 Rapid-Setting Emulsions

The rapid-setting grades are designed to react quickly with aggregate and revert from the emulsion to the asphalt. They are used primarily for spray applications, such as aggregate (chip) seals, sand seals, and surface treatments. The RS-2, HFRS-2 and CRS-2 grades have high viscosity to prevent runoff. Polymer modified versions of these emulsions are routinely used where rapid adhesion is necessary, such as in high traffic areas, when there is minimal traffic control, or where there is heavy truck traffic.

**Table 5-1 General Uses of Asphalt Emulsion**



Type of Construction	ASTM D 977 AASHTO M 208									ASTM D 2397 AASHTO M 140					
	RS-1	RS-2	HFMS-2	MS-1, HFMS-1	MS-2, HFMS-2	MS-2h, HFMS-2h	HFMS-2s	SS-1	SS-1h	CRS-1	CRS-2	CMS-2	CMS-2h	CSS-1	CSS-1h
<b>Asphalt-Aggregate Mixtures:</b>															
Plant Mix (Hot or Warm)						X <sup>1</sup>									
Plant Mix (Cold)															
Open-Graded Aggregate					X	X									
Dense-Graded Aggregate							X	X	X					X	X
Sand							X	X	X					X	X
<b>Mixed-in-Place</b>															
Open-Graded Aggregate					X	X						X	X		
Well-Graded Aggregate							X	X	X					X	X
Sand							X	X	X					X	X
Sandy Soil							X	X	X					X	X
<b>Asphalt-Aggregate Applications:</b>															
Single and Multiple Surface Treatments	X	X	X							X	X				
Sand Seal	X	X	X	X						X	X				
Slurry Seal							X	X	X					X	X
Micro-surfacing															X <sup>2</sup>
Sandwich Seal		X	X								X				
Cape Seal		X									X				
<b>Asphalt Applications:</b>															
Fog Seal				X <sup>3</sup>				X <sup>4</sup>	X <sup>4</sup>					X <sup>4</sup>	X <sup>4</sup>
Prime Coat					X <sup>5</sup>			X <sup>5</sup>	X <sup>5</sup>					X <sup>5</sup>	X <sup>5</sup>
Tack Coat				X <sup>3</sup>				X <sup>4</sup>	X <sup>4</sup>					X <sup>4</sup>	X <sup>4</sup>
Dust Palliative								X <sup>4</sup>	X <sup>4</sup>					X <sup>4</sup>	X <sup>4</sup>
Mulch Treatment								X <sup>4</sup>	X <sup>4</sup>					X <sup>4</sup>	X <sup>4</sup>
Crack Filler								X	X					X	X
<b>Maintenance Mix:</b>															
Immediate Use							X					X	X		
Stockpile							X								

**NOTES:**

1. Grades other than HFMS-2h may be used where experience has shown that they give satisfactory performance.
2. Mixed-in prime only.
3. Diluted with water by the manufacturer
4. Diluted with water
5. Mixed-in prime only.

## 5.1.2 Medium-Setting Emulsions

Medium-setting grades are designed for mixing with graded aggregate. Because these grades are formulated not to break immediately upon contact with aggregate, they can coat a wide variety of graded aggregates. Mixes using medium setting emulsions can remain workable from a few minutes to several months depending upon the formulation. Mixes are produced in pugmills and travel plants or can be road mixed. In recent years, they have been used in cold recycling applications.

Examples of medium-setting emulsions are MS-2, CMS-2 and HFMS-2. Nomenclature for medium-setting emulsions varies from state to state. Consultation with your local emulsion manufacturer is suggested for recommendations.



High-float is a special class of anionic MS emulsion. The major difference between these emulsions and the conventional medium-setting is the existence of a gel structure in the asphalt residue that is measured by the float test. The float characteristic increases film thickness. While regular asphalt may have a tendency to flow or migrate, the high-float residues are designed to stay in place up to 70°C (160°F). Therefore, high-float residues are less susceptible to changes in temperature and very resistant to flow at high temperatures during the summer.

Polymer modified versions of medium-setting emulsions may be used where additional stability or improved durability is needed or where improved water resistance is important.

### **5.1.3 Slow-Setting Emulsions**

The slow-setting grades are designed for mixing stability. They are used with high fines content, dense-graded aggregates. The slow-setting grades have long workability times to ensure good mixing with dense-graded aggregates. These mixes are not designed for stockpile storage. All slow-setting grades have low viscosity that can be further reduced by adding water. When diluted, these grades can also be used for tack coats and fog seals and as dust palliatives. The slow-setting grade of emulsion depends mostly upon evaporation of the water for coalescence of the asphalt particles. The slow-setting emulsions in mixing applications are generally used for dense-graded aggregate-emulsion bases, soil-asphalt stabilization, asphalt surface courses and for some recycling and slurry sealing.

Polymer modified slow-setting emulsions may be used where additional mixture stability is needed or a better bond is necessary, the latter in the case of a tack coat or fog seal.

### **5.1.4 Quick-Setting and Micro-Surfacing Emulsions**

Quick-setting and micro-surfacing emulsions are not currently specified by ASTM or AASHTO. They are, however, widely used across the country.

The quick-setting grades are designed specifically for slurry seal applications when a quick curing time is necessary. This allows a quicker opening to traffic than the slow-setting slurry seal emulsions. Quick-setting slurry seals are designed to be placed at the thickness of the largest aggregate in the gradation.

Micro-surfacing emulsions are polymer modified and allow mixes to be placed at greater thickness than slurry seals. The newly micro-surfaced pavement can normally be opened to traffic in less than an hour after placement. Laboratory evaluation is more important for quick-setting and micro-surfacing emulsions to determine compatibility with job aggregates. The emulsion supplier should be contacted for recommended acceptable aggregate sources.

## 5.2 Guidelines for Successful Performance

The success with any type and grade of asphalt emulsion system is best ensured by strictly adhering to these steps:



1. Conduct complete laboratory testing using the actual aggregate and emulsion that are to be used on the project.
2. Select grades in conformance with **Table 5-1 General Uses of Asphalt Emulsion** and the previous information.
3. Adhere to the specifications and guides for usage.
4. Carefully handle the emulsion to prevent contamination, settlement of the asphalt droplets or premature coalescence.
5. Contact the emulsion manufacturer's representative when special or unusual problems occur.